REMARKS

This application has been carefully reviewed in light of the Office Action dated June 30, 2006. Claims 1-14 and 18-19 remain in this application. New Claims 18-19 have been added. Claims 15-17 have been canceled without prejudice. Claims 1, 2, 10, and 11 are the independent claims. Claims 1 and 2 have been amended. It is believed that no new matter is involved in the amendments or arguments presented herein. Reconsideration and entrance of the amendment in the application are respectfully requested.

Art-Based Rejections

Claims 1-5, 7-11, and 15-17 were rejected under 35 U.S.C. § 103(a) over JP 06-069032 (Takanabe) in view of U.S. Patent No. 6,841,259 B1 (Takahashi). Applicant respectfully traverses the rejections and submits that the claims herein are patentable in light of the clarifying amendments above and the arguments below.

The Takanabe Reference

Takanabe is directed to a magnetic head having a multilayer magnetic thin film with a first layer of Fe-N and a second layer of Co amorphous alloy (*Takanabe, Abstract and Figure 1).*

The Takahashi Reference

Takahashi is directed to a magnetic thin film and a method of producing the same. More particularly, the present invention relates to a magnetic thin film having both high saturation magnetic flux density and small coercive force, which is suited for increasing the recording density and frequency. According to Takahashi,

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the magnetic thin film consists of an iron carbide film. The iron carbide film includes a α' phase as a principal phase and at least carbon and iron as constituent elements.

The Claims are Patentable Over the Cited References

The present application is generally directed to a magnetic thin film having high saturation magnetization and exhibits high permeability and a high quality factor Q in the high frequency band of GHz range.

As defined by amended independent Claim 1, a high frequency magnetic thin film includes a first layer comprising a T-L composition, wherein T is Fe or FeCo and L is only C. A second layer includes a Co-based amorphous alloy arranged on either surface of the first layer. The first layer has a bcc structure.

The applied references do not disclose or suggest the features of the claim of the present invention. In particular, the applied reference fails to disclose and suggest "a first layer comprising a T-L composition (here, T is Fe or FeCo, L is only C); and a second layer comprising a Co-based amorphous alloy arranged on either of the surfaces of said first layer," as recited in amended independent Claim 1.

Takanabe discloses "iron-nitrogen compound layers." (*Takanabe, Claim 1*). However, Takanabe does not teach nor suggest a T-L composition wherein L is C. Magnetic thin film of Takanabe shows soft magnetic properties (coercive force) of 1 Oe or less, and the saturation magnetic flux density thereof is approximately 1 T (in its examples, the saturation magnetic flux density is 1.2 T or 1.3 T.). In contrast, the high frequency magnetic thin film of the present invention shows saturation magnetization exceeding 1.4 T when the coercive force (Hce) thereof is 1 Oe or less as shown in FIG. 25 of Specification, and the saturation magnetization reaches 1.6 T when the coercive force (Hce) thereof is at around 1 Oe. Since $B = \mu_0 H + I$

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(wherein "B" is magnetic flux density, "I" is magnetization, μ 0 is permeability in vacuo, and H is magnetic field), higher saturation magnetic flux density is obtainable according to the high frequency magnetic thin film of the present invention, than the magnetic thin film of Takanabe. In addition, one aim of the present invention is to exhibit high permeability in the high frequency band of GHz range (See [0001] of US 2005/0116803 A1), and according to the high frequency magnetic thin film of the present invention, the following properties are obtainable:

the real part (μ') of the complex permeability at 1 GHz is 400 or more and the quality factor Q (μ'/ μ") is 4 or more, and further

the real part (μ') of the complex permeability at 1 GHz is 500 or more and the quality factor Q (μ'/ μ") is 10 or more.

In contrast, Takanabe does not mention nor suggest permeability in the high frequency band of GHz range.

Moreover, Takahashi teaches an iron carbide film including an α' phase as a principal phase and at least carbon and iron as constituent elements (*Takahashi, Claim 1*). However, the α' phase is a martinsite phase as shown in the claims 1 and 27 of Takahashi; and the martinsite phase has a bct structure (body-centered tetragonal structure) as shown in the claim 27. That is, the crystal structure of the iron carbide film of Takahashi is different from that of the T-L composition according to amended independent Claim1. Moreover, the α' phase having a martinsite phase proposed by Takahashi is difficult to generate by the ordinary sputtering method. It requires special treatment such as a heat treatment of the substrate 39 *(Takahashi, Embodiments 1 and 2)* and a high- grade vacuum device. For example, the Embodiment 1 of Takahashi discloses that "Before forming the film, the substrate 39 was heat-treated at 200 degrees in a vacuum for two hours and then the substrate 39 was cooled to 20 degrees and the iron carbide film with a

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desired composition was deposited on the substrate 39 kept at this temperature." (*See Takahashi; col. 19, lines 14-18*). In contrast, it is possible to produce the T-L composition having a bcc structure as recited in amended independent Claim1 by a method of ordinary sputtering, and therefore advantageous in producing the high frequency magnetic thin film.

Furthermore, although Takahashi discloses a magnetic thin film consisting of an iron carbide film (*Takahashi, Claim 1*), it fails to disclose a Co-based amorphous alloy. More specifically, Takahashi discloses that "Various magnetic characteristics described above can be obtained more stably by forming an iron carbide film on a thin film having almost the same interatomic distance as that of the iron carbide film. Examples of the thin film include an iron film having the (200) plane as the surface." (*See Takahashi; col. 11, lines 35-40*). However, an iron film does not correspond to a Co-based amorphous alloy recited in amended independent Claim 1.

Moreover, Takahashi discloses the following:

> To obtain various magnetic characteristics described more stably, the element constituting the thin film is preferably an element having almost the same lattice constants as those of the iron carbide film. When using a thin film consisting essentially of an element having almost the same lattice constants as those of the iron carbide film, the initial growth of the iron carbide film to be deposited thereon is conducted very stably and a film having higher crystallizability is attained by suppressing the occurrence of magnetostriction in the film even if the film thickness increases, thus obtaining an iron carbide film having various stable magnetic characteristics. Examples of an element having almost the same lattice constants as those of the iron carbide film include one or more elements selected from Ag, Au, Pd, Pt, Rh, Al, Ir, and Ru. (*See Takahashi; col. 11, lines 41-55*).

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However, Co is not listed as an element suitable for a layer arranged on the iron carbide film. Thus, Takahashi fails to disclose and suggest "a first layer comprising a T-L composition (here, T is Fe or FeCo, L is only C); and a second layer comprising a Co-based amorphous alloy arranged on either of the surfaces of said first layer," as recited in amended independent Claim 1.

Moreover, Applicant respectfully submits that Takanabe and Takahashi cannot be combined to obtain the features of amended independent Claim 1. Takahashi fails to disclose a Co-based amorphous alloy and there is no motivation of applying the iron carbide film disclosed in Takahashi to Takanabe.

Moreover, Takanabe proposes that a heat treatment be performed on a multilayer film obtained by laminating alternately iron-nitrogen compound layer 2 and Co amorphous alloy layer 3 to diffuse nitrogen into the layer 3 from the layer 2 (*Takanabe, Claim 2*), in order to improve the heat resistance of Co amorphous alloy layer 3. However, nitrogen is a gas, whereas carbon is a solid. Therefore, if a heat treatment is performed on a multilayer film wherein the iron carbide film disclosed in Takahashi is applied to the Takanabe's multilayer film, it is very difficult to diffuse carbon into the Takanabe' s Co amorphous alloy layer 3. Even if the iron carbide film disclosed in Takahashi is applied to the Takanabe' s multilayer film, an improvement on heat resistance of Co amorphous alloy layer 3, which is the aim of Takanabe, will not be expected.

Furthermore, Takanabe proposes to perform a heat treatment on a multilayer film. In contrast, Takahashi discloses that "The iron carbide film comprising an α' phase as a principal phase to be formed in the above step has the advantage that, since the film is formed stably in a so-called As-depo state immediately after forming the film without subjecting it to a heat treatment after

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forming the film, no thermal effect is exerted on an element consisting of another magnetic film, e.g. a magnetoresistive element, even if the element is formed on the substrate before the iron carbide film is formed." (*See Takahashi; col. 12, lines 34-43*). If the Takahashi's iron carbide film was applied to the Takanabe' s multilayer film, the above-mentioned advantage obtainable by Takahashi would be lost.

Accordingly, the application of the Takahashi's iron carbide film to the Takanabe's multilayer film is difficult, and therefore, there is no motivation to combine those references to obtain the feature of amended independent Claim 1.

Regarding independent Claim 2, the applied references do not disclose or suggest, "a first layer comprising a T-L composition (..., L is only C)," as recited in that claim. As discussed above, Takanabe discloses "iron-nitrogen compound layers." (*Takanabe, Claim 1*). However, Takanable and Takahashi are silent a T-L composition wherein L is C, as recited in amended independent Claim 2.

Moreover, the applied references do not disclose or suggest, "a second layer comprising a Co-based amorphous alloy arranged on either of the surfaces of said first layer," as recited in amended independent Claim 2.

As discussed above, the applied references are silent regarding a Co-based amorphous alloy, and a layer comprising a Co-based amorphous alloy arranged on either of the surfaces of the iron carbide film.

Moreover, the applied references do not disclose or suggest, "a plurality of said first layers and one or more said second layers are laminated to form a multilayer film structure," as recited in amended independent Clam 2.

Takanabe discloses a multilayer film in which iron-nitrogen compound layers 2 and Co amorphous alloy layers 3 are laminated. However, Takahashi disclose that the magnetic layer 11 of α' —Fe-C film is formed on the substrate 10, as shown in the Embodiment 1 and FIG. 1A of Takahashi. The Fe buffer layer 12 is formed

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on the substrate 10, and the magnetic layer 11 of α' —Fe-C film is formed on the Fe buffer layer 12 as shown in the Embodiment 2 and FIG. 1B of Takahashi. In FIG. 1A and FIG. 1B, the magnetic layer 11 of α' — Fe-C film is a single layer. Takahashi does not teach nor suggest a plurality of T-L composition layers and one or more Co-based amorphous alloy layers are laminated to form a multilayer film structure, as recited in amended independent Claim 2.

Furthermore, Applicant respectfully submits that there's no motivation to combine Takanabe and Takahashi to obtain the features of independent Claim 2. In particular, there no motivation to apply the Takahashi's α' —Fe-C film which is a single layer to the Takanabe's multilayer film in which iron-nitrogen compound layers 2 and Co amorphous alloy layers 3 are laminated.

As mentioned above, it is well known in the art that the Takahashi's α'—Fe-C film is difficult to generate using the ordinary sputtering method. On the contrary, it requires special treatment such as a heat treatment of the substrate 39, as disclosed in Embodiments 1 and 2 of Takahashi.

Takahashi is directed to obtaining the single layer of α'-Fe-C film by executing the heat treatment of the substrate. However, when the person skilled in the art intends to attain a multilayer structure in which a plurality of Fe-C films and one or more Co-based amorphous alloy layers are laminated, it is difficult to form the a'-Fe-C film desired by Takahashi, depend on the lamination number of Fe-C films and Co-based amorphous alloy layer(s).

Accordingly, one of ordinary skill in the art would not look to the teaching of Takahashi to obtain the features of amended independent claim 2. The present Claim 2 provides a high frequency magnetic thin film with the excellent properties such that the real part (μ') of the complex permeability at 1 GHz is 400 or more and the quality factor Q (μ'/μ") is 4 or more, and further the real part (μ') of the complex

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permeability at 1 GHz is 500 or more and the quality factor Q (μ'/μ") is 10 or more. Such properties are not obtained by Takanabe and Takahashi.

Regarding independent Claim 10, the claim recites that first layer is constituted with a columnar structure of 1.4 or less aspect ratio or an amorphous structure. Takanabe is silent regarding that feature.

Takahashi is not seen to remedy the deficiencies of Takanabe. Page 7 and 8 of the present specification discloses the following:

> (1) An Fe-C thin film having a predetermined thickness has columnar structure, but when the thickness is of the order of 70 nm or less, excellent soft magnetic properties can be obtained because the aspect ratio of the columnar structure (the ratio of the column length to the column width, the length/the width) is small. More specifically, the average width of the grown Fe-C columns is about 50 nm, and the degradation of the soft magnetic properties due to the columnar structure can be suppressed as far as the thickness is of the order of 70 nm for which the aspect ratio of the columnar structure is 1.4 or less. For the purpose of obtaining an Fe-C thin film having such an aspect ratio, as shown in Fig. 3, it is effective that a Co-based amorphous alloy thin film 111 is interposed between an Fe-C thin film 112 and another Fe-C thin film 112. In this way, the continuous columnar growth of the Fe-C grains can be prevented.

Takahashi's table 1 and table 2 discloses that the thickness of α' —Fe-C film is 300nm, i.e., exceeding 70nm. Therefore, it is believed that the Takahashi's α' —Fe-C film has a columnar structure with an aspect ratio more than 1.4.

Accordingly, the combination of Takanabe and Takahashi do not disclose or suggest the features recited in independent Claim 10.

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Regarding independent Claim 11, that claim recites similar features as independent Claim 2, and therefore is believed to be allowable for at least the same reasons as independent Claim 2. Such allowance is respectfully requested.

Since the applied references, alone or in combination, do not disclose or suggest the features of the present invention as recited by amended independent Claims 1, 2, 10, and 11, those references cannot be said to anticipate nor render obvious the invention which is the subject matter of that claim.

Accordingly, independent Claims 1, 2, 10, and 11 are believed to be in condition for allowance and such allowance is respectfully requested.

The remaining Claims depend either directly or indirectly from independent Claims 1, 2, 10, and 11 and recite additional features of the invention which are neither disclosed nor fairly suggested by the applied references, and are therefore also believed to be in condition for allowance, and such allowance is respectfully requested.

Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (310) 785-4721 to discuss the steps necessary for placing the application in condition for allowance.

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If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
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